ABSTRACT:

The effect of bluff body on stabilization of liquid petroleum gas (LPG) - air premixed burner flame has been experimentally investigated. One of the objectives of this experimental work was to perform an analysis on the effect of the bluff-body shape on flame stabilization. A method of aerodynamically stabilizing lean premixed natural gas flames on a conventional burner was investigated. The analysis of premixed flames stabilization process was focusing mainly on the shape and sizes of flame holders. To study the influence of the bluff-body shape on the stabilization process, four flame-holders were considered: a rod, a wire and rings of several diameters. Flames were anchored in the wake behind a small ring placed in the exit plane of a conventional burner. The stabilization conditions were based on the description of the stability domain and of the characteristic flame modes. Direct visualizations allow a better knowledge of these different regimes: laminar stable flame, transition and unstable flame. An aerothermodynamic description of the reacting flow in the bluff-body wake was performed over a range of Reynolds numbers and mixture equivalence ratios. The objective was to extract from this analysis, the differences in the flame structure due to the bluff-body geometry and their consequences on the stabilization diagram. Results show the existence of various types of flames, according to the classical premixed burner flame, but the influence of the bluff-body shape on these stabilization regimes is also demonstrated. Comparison between the flow without bluff body and with bluff body on flow as well as flame stabilization was discussed. It was found that the stabilization of the flame is improved by having bluff bodies on downstream of the flow. Without bluff body the stability region of the flame is limited or in general the flame is easier to blow off and flashback. The overall with bluff body stability regime of the burner was significantly increased, permitting stable lean premixed combustion. The influence of the ring with different diameters on flame stability limit was also investigated.